YELLOW-POPLAR

. . . an American wood

Yellow-poplar is one of the top commercial hardwood species in the United States because of its availability, rapid growth, excellent form, freedom of branching, and good working qualities. It was second only to oak in lumber production in 1963, and third in hardwood veneer log production in the same year. The species ranks third in volume of lumber used in the furniture industry, but ranks first in the North Carolind furniture industry—the Nation's major producer of wooden furniture. Because of yellow-poplar's importance to the wood-using industries, forest scientists have developed extensive research programs to propagate, protect, and utilize the species.

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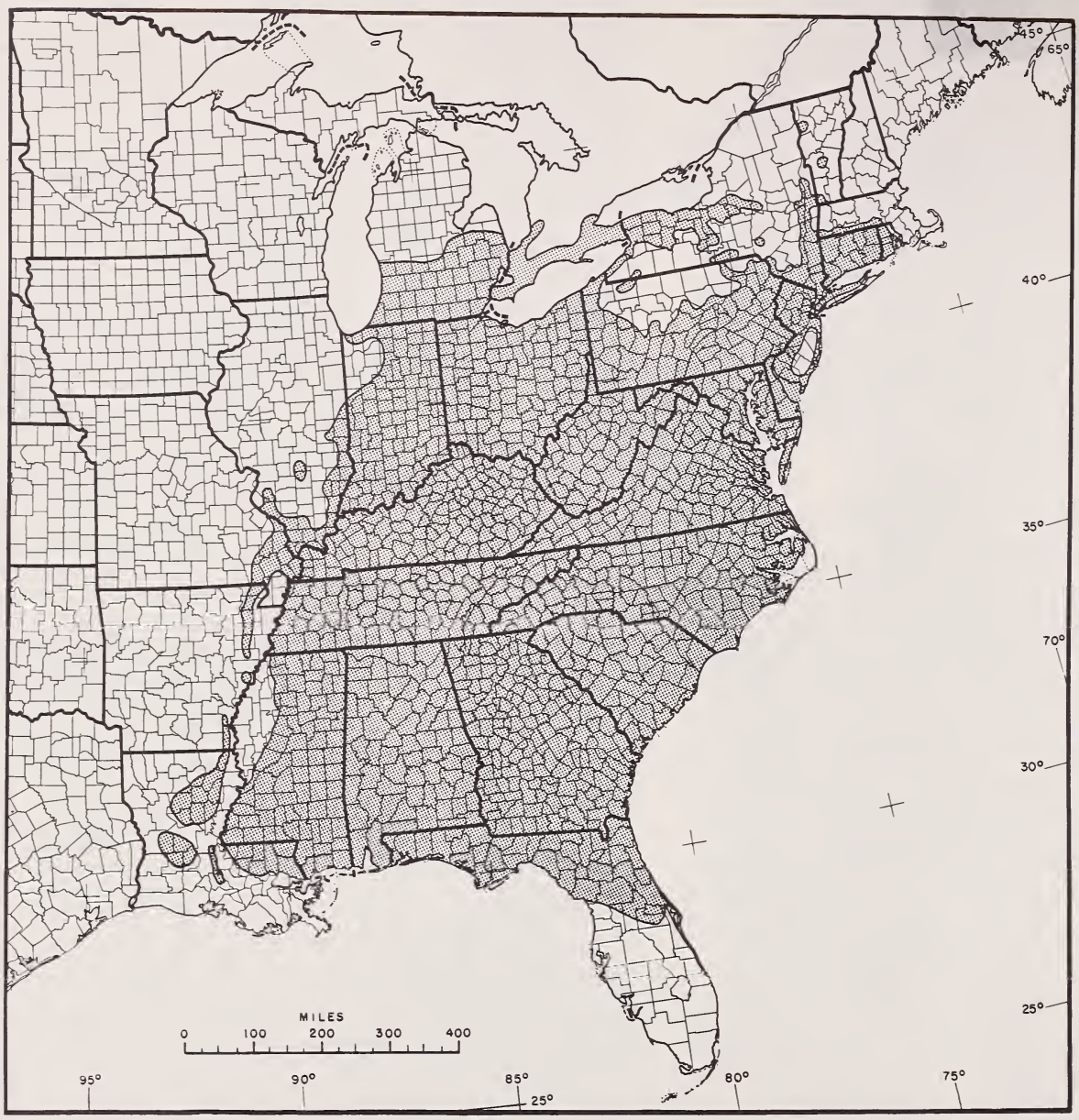

Figure 1.—Natural range of yellow-poplar.

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YELLOW-POPLAR

(*Liriodendron tulipifera* L.)

Charles B. Vick[1]

DISTRIBUTION

Stands of yellow-poplar range over practically the whole of the Eastern United States; they extend northward into Massachusetts, central New York, and Michigan; westward into Illinois, Arkansas, and Louisiana; and southward to the Gulf Coast and central Florida (fig. 1). The most extensive stands grow on the Appalachian Mountain slopes of Virginia, North Carolina, Georgia, Tennessee, Kentucky, and West Virginia, and also in the lower Ohio River Basin.

Yellow-poplar is a major species in four forest cover types: pure yellow-poplar; yellow-poplar and hemlock; yellow-poplar, white oak, and northern red oak; and sweetgum and yellow-poplar. It is a minor component in 12 other forest types.

Yellow-poplar grows within a wide range of climatic conditions. Temperature extremes vary from moderately severe winters in the southern New England States to almost frost-free winters in central Florida. Rainfall varies from 30 inches to more than 80 inches in some areas of the southern Appalachians. Optimum growth occurs when rainfall is well distributed over a long growing season. Adequate rainfall early in the growing season has more effect on diameter growth than total rainfall over the whole season.

Aspect, position on slope, and elevation of a yellow-poplar site are important factors influencing its quality. At the northern end of its range where temperatures are limiting, yellow-poplar is usually found in valleys and stream bottoms at elevations below 1,000 feet. In the Appalachian Mountains up to elevations of 4,500 feet, it grows on a wide variety of sites, including stream bottoms, coves, and moist slopes. Toward the southern limit of the range, where high temperature and soil moisture may become limiting, the species is usually confined to well-drained stream bottoms.

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NOTE: This publication supersedes "Yellow-Poplar," unnumbered, issued 1954.

DESCRIPTION AND GROWTH

The mature yellow-poplar has a striking appearance. In forest stands, its trunk is very straight and tall, and clear of lateral branches for considerable distance up the bole. Even though most yellow-poplar forests have been cut within the last 50 years, some older trees can occasionally be found that have attained a height of 160 feet or more and a massive trunk, 8 feet or more in diameter. It is probably the tallest of all Eastern U.S. broad-leafed trees.

The leaves (fig. 2) of yellow-poplar are distinctive, with a silhouette resembling a tulip. They are 4 to 6 inches in breadth, and mostly 4-lobed. The base and apex are nearly truncate, or the apex may be broadly notched. The flowers (fig. 2) appear in late May or June after the leaves unfold. They are cup-shaped, 1½ to 2 inches wide, with six light, greenish-yellow petals arranged in two rows. The fruit (fig. 2) is a 2½- to 3-inch long, erect, cone-like aggregate of terminally winged samaras. The samaras fall from a more or less persistent axis at maturity. Twigs (fig. 3) are moderately stout, reddish-brown, and bitter to the taste. Terminal buds (fig. 3) are ½-inch long, flattened, and appear "duck-billed" because only two outer bud scales are visible. The bark on young trees is dark green and smooth with a white, spotty appearance. Later the bark breaks up into long, rough, interlacing, rounded ridges (fig. 4) separated by deep ash-gray fissures.

For good growth and form, yellow-poplar is exacting in soil and moisture requirements. Where it occurs naturally, the sites are usually moist, well-drained, loose-textured soils. It rarely grows well on badly eroded upland sites or on very dry or very wet soils.

Although yellow-poplar is a prolific seeder—300,000 or more seeds per acre are not uncommon—only about 5 to 10 percent are viable. In order for the viable seed to germinate and develop early, it is necessary that the seed have full sunlight and be in contact with bare mineral soil. It is also essential that the soil be moist and well-drained. Once seedlings are established, they must maintain a dominant position relative to other vegetation if they are to survive. This usually means

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Figure 2.—Mature leaf, twig, fruit, and flower of yellow-poplar.

that heavy cutting of timber and scarification of topsoil are needed before seeding. Sometimes competing vegetation must be cut out to free the developing seedlings.

Yellow-poplars are inherently capable of making vigorous growth on favorable sites during the seedling and sapling stages. Although height growth may be only a few inches to a foot during the first year, rapid growth will begin in the second year on favorable sites with full light. After 5 years, total height may be 10 to 18 feet.

Yellow-poplar sprouts readily and vigorously from stumps, and frequently develops satisfactorily in clumps; sprout stands, however, are not as desirable as seeded stands of plantations. Trees from stump sprouts are likely to develop heart rot, or the stump may rot away, leaving little support for the tree. Nevertheless, sprouts are quite vigorous, often outgrowing both yellow-poplar seedlings and the sprouts of competing species.

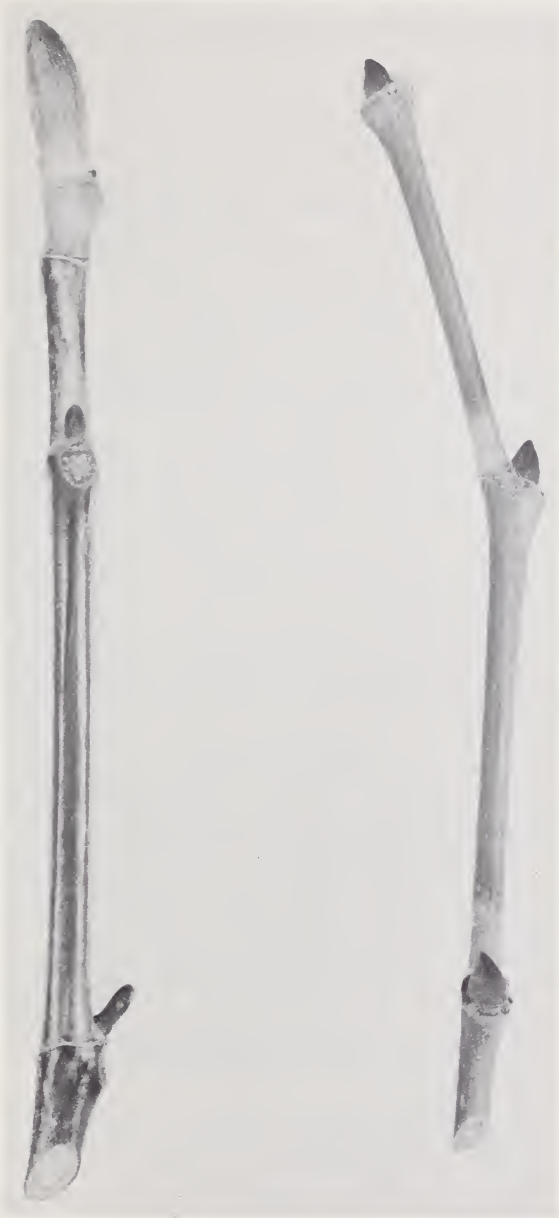

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Figure 3.—Twig and buds of yellow-poplar.

COMMON NAMES

The accepted common name is yellow-poplar, but it is misleading since the true poplars are found only in the willow family. The tree also bears other descriptive names, such as tuliptree, tulip-poplar, white-poplar, white wood, and "poplar."

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Figure 4.—Bark of mature yellow-poplar.

RELATED COMMERCIAL SPECIES

Small quantities of magnolia (*Magnolia grandiflora* L. and *M. virginiana* L.), because of their similarity to yellow-poplar, are often mixed with and sold as yellow-poplar.

SUPPLY

The 1963 nationwide forest survey conducted by the Forest Service placed net volume of yellow-poplar sawtimber on commercial forest land at approximately 21,200 million board feet. The largest sawtimber stands, 32 percent of the total, were found in the three South Atlantic States of Virginia, North Carolina, and South Carolina. About 28 percent were distributed over the Middle Atlantic States, with the greatest volumes occurring in West Virginia, Maryland, and Pennsylvania.

The East, Central, and West Gulf States regions accounted for more than 21 percent of the total, with the Central Gulf region predominating. The States of Georgia, Tennessee, and Alabama contained the largest volumes in these regions. A substantial 18 percent was found among the Central States, mainly in Kentucky and Ohio. Only about 6 percent of the total stand was in the New England and Lake States.

PRODUCTION

The first recorded yellow-poplar lumber production was 320 million board feet in 1869. Thirty years later (1889), production reached an all-time high of 1,118 million board feet and then followed an irregular decline to an all-time low of 86 million board feet in the Depression year of 1932. A relatively sharp rise followed, with a peak of 833 million board feet being reached in 1950. From then until 1964, the trend leveled off between a high of 690 million board feet in 1955 and a low of 541 million board feet in 1961. The latest 1964 estimate was placed at 645 million board feet.

The lumber production trend of yellow-poplar very closely followed the production trends for all hardwood species over the 1950 to 1964 period (table 1). Yellow-poplar averaged about 9.6 percent of all hardwood production, but with a slight downward trend in percentage during these years. Since 1961, lumber production for yellow-poplar and all hardwoods has been increasing.

Veneer log production was 26 million board feet in 1905, and maintained a volume around that figure until 1923 when production jumped to more than 45 million board feet. A steady rise continued from that time until the 1929 crash, when about 72 million board feet were produced, and then markedly decreased. Over the next 10 years, production made a partial recovery to 59 million feet. Approximately the same level was maintained over the prewar and war years. By 1951, production almost tripled to 160 million feet. In 1963, veneer log production was more than 150 million board feet.

TABLE 1—*Yellow-poplar and total hardwood lumber production from 1950 through 1964* [1] [2]

Year	Million board feet		Percent volume of all hardwoods
	Volume of yellow-poplar	Volume of all hardwoods	
1950	833	7,374	11.3
1955	690	7,565	9.1
1958	615	6,006	10.2
1959	655	6,657	9.8
1960	592	6,254	9.5
1961	541	5,953	9.1
1962	617	6,359	9.7
1963	644	7,154	9.0
1964	645	7,275	8.9

[1] Figures prior to 1961 exclude Alaska and Hawaii.
[2] Bureau of Census. Statistical abstract of the United States. U.S. Department of Commerce, 87th Annual Edition, 1966.

CHARACTERISTICS AND PROPERTIES

The heartwood of yellow-poplar is usually tan or greenish-brown, but may be quite variable, with shades of purple, dark green, black, blue, and yellow. These colorations have no apparent effect on the physical properties of the wood, and may be objectionable only when natural finishes are applied. The sapwood is whitish, and may have a striped appearance. The wood is without characteristic odor or taste.

The growth rings are distinct, being delineated by a narrow, whitish line of terminal parenchyma cells. The pores are so small that they cannot be seen with the naked eye. They are fairly uniformly distributed throughout the growth ring. The rays are distinct and uniform in width.

Second-growth wood is generally straight-grained and comparatively uniform in texture. Its specific gravity averages 0.42, based on ovendry weight and volume at 12-percent moisture content. Yellow-poplar is rather soft, moderately weak in bending and end compression, moderately stiff, and rather low in shock resistance. During seasoning, the lumber is intermediate in its tendency to warp: it undergoes a relatively large amount of shrinkage, but stays in place well after seasoning. It dries quickly and with very few defects developing in air seasoning yards, dry kilns, and forced-air driers. The wood is easily worked with handtools, glues satisfactorily over a rather wide range of gluing conditions, and takes and holds paint and enamel exceptionally well. Yellow-poplar lumber weathers with inconspicuous checking, but will cup and pull loose from fastenings. Both sapwood and heartwood are low in decay resistance.

Yellow-poplar has the reputation of being one of the easiest of all hardwoods to work with handtools. But like most other woods, it has good as well as poor machining properties. Generally, it ranks about average in machining properties with the 25 most important furniture woods. Yellow-poplar has good turning and boring properties. It can be planed satisfactorily, but it is poor in shaping and sanding characteristics. The wood is about average in its ability to accept nails and screws without splitting.

Yellow-poplar is well suited to the manufacture of veneer, especially in the rotary-cutting process. Most of it is cut in Southeastern plants for utility veneers—cross-bands, cores, and backs for plywood panels. The wood has been considered by many authorities as the best American cross-band material.

Yellow-poplar is included in an important group of soft, low-density hardwoods called the "poplars" that are used in pulp and paper manufacture. They can be pulped by chemical, semichemical, or groundwood processes to yield short-fibered pulps, relatively low in strength but suitable for various grades of wrapping and printing papers, container boards, and insulating boards. Chemical pulp yields of yellow-poplar in the sulfite, sulfate, and soda processes are 47, 47, and 45 percent, respectively.

PRINCIPAL USES

In its primary manufacturing stages, yellow-poplar is cut principally into lumber, veneer, pulpwood, and bolts. Lumber goes mostly into furniture and fixtures, boxes and shook, millwork, core stock for veneer panels, dimension stock, and miscellaneous uses such as musical instruments, morticians' goods, toys, and sporting goods. Most veneer goes into plywood—as cross-bands, cores, and backs that later find their way into furniture manufacturing. Extensive use is made of veneer in wirebound boxes and crates, veneer, and plywood containers. Pulpwood usually finds its way into paper by way of the soda process. Bolt wood goes into specialty products mills, hardwood dimension, and veneer and plywood containers.

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